



CORRELATION BETWEEN ANTHER NUMBER, POLLEN PRODUCTION AND POLLINATION EFFICIENCY

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ABSTRACT

AIM

To determine a relationship between the number of anthers present in a flower, pollen production per anther and number of pollen grains produced in the given flower in anemophilous plants and to analyze the effect of this relation on the overall pollination efficiency of the flower.

This project aims to determine the relation between the number of anthers per flower, pollen production per anther and pollen production in a given flower of the species. By analyzing these parameters, the impact of pollination efficiency can be determined. Through careful data collection, observations and analysis, it is concluded that an increased number of anthers causes increased pollen production, thereby causing better pollen dispersion and higher fertilization possibility. Furthermore, increase in anthers decreases the stress on anthers thereby causing an increased quality of the pollen grains. This can be used to perform genetic modifications on specific plants to increase pollen producing efficiency and number. The findings of this research will allow better understanding of reproductive strategies used by specific plants and provide insights on their conservation.

KEYWORDS: Pollination Efficiency, Anther, Anemophilous Plants, Pollen Dispersion, Quality

INTRODUCTION

Anther is a part of flowering plants that engage in the production of the male gamete. Wind-pollinated flowers release a large number of pollen grains. This is to increase the chances of pollination. In nature, flowers are observed to have a large variation in the number of anthers in the flower. Pollen production in plants varies greatly depending on various factors including

- Location: For anemophilous plants, the presence of more winds in the area reduces the requirement for more pollen grains
- Atmospheric humidity: Increase in atmospheric humidity reduces the pollen carrying ability of the air.
- Size of the flowers of the species: Increase size is linked to an increase in pollen production of the flower.

Though studies on pollen production of flowers are extensive, the relation between the number of anthers and the number of pollen grains produced per flower is few. This project aims to establish this relation and to analyze the impacts of the pollen grain production per anther on the overall pollination efficiency of the plant.

The pollen production of a given anther also depends on various factors including:

- Genetics: Pollen production depends on the pollen-generating ability coded by the genes of the plant.
- Development stage of the anthers: The greatest pollen generation occurs when the anthers are mature.
- Nutrient availability: Rich sources of magnesium and

potassium are crucial

As the sources used in this project are secondary sources, various limitations exist which include

- Existence of bias: the researchers of the samples used may be biased, giving incorrect results
- Data may not be entirely reliable and may provide falsely obtained values.
- Data may not be relevant to the scope of the research.

All these limitations have been taken into account while composing this project. Sources have been carefully chosen to increase reliability and sources providing biased information have been filtered out. This results in accurate observations leading to accurate analysis of the topic.

MATERIALS AND METHODS

The information about pollen production in various plants has been obtained from reliable research papers as mentioned in the references. Though the information required for this study has been derived from available sources, various methods and techniques have been implemented to determine the number of pollen grains released per anther. Some of these techniques include:

- By using image processing and counting: Pollen was collected from anthers of each species, then illuminated on slides and digitally photographed through a stereomicroscope. These images were processed to remove noise and sharpen the pollen grains, then analyzed to obtain a dependable total count of the number of grains present in

the image.

- A more traditional way includes obtaining anthers from closed flowers kept in 70% ethanol which are then washed in distilled water and placed in test tubes. With the assistance of a glass rod, they were taken apart and, in most cases, the pollen grains were suspended in distilled water. From this concentrate, five drops of 10 μ L are removed and then the pollen grains are counted.

Statistical techniques like correlative analysis and linear regression have been used to provide the most accurate correlation between the given factors. Using the data obtained with the above methods, careful analysis can be done on the correlation between the number of anthers and pollen production in the anther and flower.

RESULTS AND DISCUSSIONS

• Compiling data for analysis

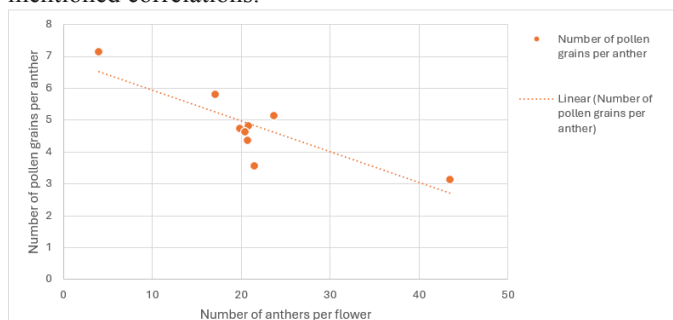
Using data from various sources as mentioned in the reference, the following data was compiled. The data has been verified by comparing similar data readings in other research papers.

S. No	Name of the flower	Number of anthers per flower	Number of pollen grains per flower	Number of pollen grains per anther
1	Pinus	43.58689	0.13326	3.103
2	Ulmus	3.999533	0.028318	7.109
3	Juglans	23.79321	0.080789	5.106
4	Platanus	23.79321	0.080789	5.106
5	Quercus	17.19532	0.063299	5.774
6	Populus	21.59391	0.067309	3.538
7	Salix	20.86081	0.070465	4.806
8	Acer	19.88335	0.067024	4.706
9	Olea	20.77936	0.068266	4.35
10	Fraxinus	20.50784	0.068585	4.62

Table 1: Compilation of data for anther, pollen relations.

- Analyzing correlations between number of pollen grains per anther and number of anthers from flower

The following graph, obtained using statistical analytic techniques like linear regression, accurately shows the above-mentioned correlations.



Graph 1: Relation between no. of pollen grains per anther and no. of anthers per flower.

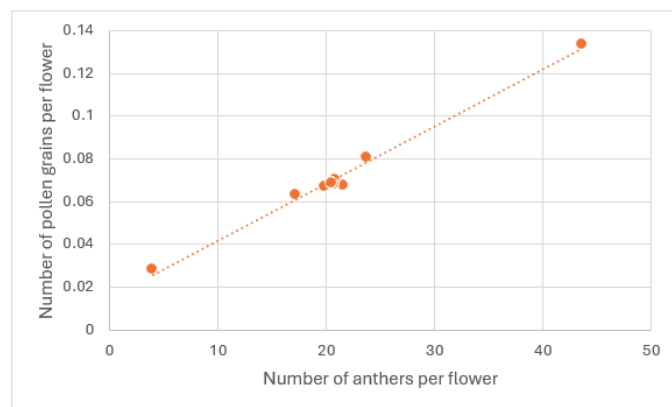
It is observed that as the number of anthers per flower increases, the number of pollen grains per anther decreases. This indicates that each anther produces lesser pollen grains when more anthers are present.

- Effect of number of pollen grains per anther on pollen quality
Lesser number of pollen grains produced by an anther leads to lesser stress of pollen production on the anthers which in turn can be related to the quality of pollen produced. Though there is no proved relationship between stress on anther and quality of pollen produced, the possible increase in quality of pollen can be linked to the following aspects:
 - Increased nutrient allocation due to lesser number of pollen grains produced.
 - Reduced competition for resources that are essential for the development of pollen grains.
 - Various research papers such as citation '1' given in the references highlight the importance of nutrients such as boron and phosphorus in pollen germination.

However, there exist other factors like humidity and genetics which control the quality of pollen grains, and the quality of pollen is not only dependent on competition and nutrient sourcing.

- Relation between the number of pollen grains produced per flower and number of anthers per flower.

The following graph which has been obtained by using statistical analysis like linear regression gives the required relation accurately.



Graph:2 Relation between number of pollen grains produced per flower and number of anthers per flower

From the graph, it is observed that there is a linear increase in the pollen production per flower as the number of anthers per flower increases. This is crucial to understand the role of anthers in overall number of pollen production by plants. The increase shows that even though there is a decrease in pollen production per anther as the anther number increases, there is an overall increase in pollen production of the flower. This aids in better pollen dispersal and increased chances of pollination as discussed in the following paragraphs.

- **Implications of the above derived correlations on biological aspects of the flower.**

The following are the effects of the pollen and anther relations derived above and how they affect pollination of the flower

- Increased pollen dispersion distance
 - As the number of pollen grains increases for an increase in the number of anthers in the flower, the overall dispersion ability of the pollen also increases.
 - Reduced competition mentioned earlier helps in creation of pollen grains with physically stronger exines protecting them from desiccations and wind currents.
- Effect on evolution stress
 - The presence of a more or lesser number of anthers results in a greater likelihood of evolution. Causing a shift of evolution towards the more favorable number of anthers.
 - Also, the disadvantages of having greater anther number has to be taken into account.

- **Relating the above correlation to agricultural usage and the produce of the given plant**

Agriculture is one of the most important aspects of most economies. Hence, the importance of the above correlation on agricultural usage and the produce of the given plant is crucial to understand its effect on agriculture.

- Understanding the effects of the above correlations can be used to increase yield of the given plant.
- Further, relations between pest resistance and the anther number can be used to make plants more pest resistant.

- **Future Research Scope**

Observing the implications of anthers of flower and pollination of the flower, more research can be carried out on the following aspects for further understanding of the following:

- Effect of anther number and pollen producing stress on the pollen quality.
- Effect of other factors crucial for pollination of anemophilous plants and understanding their dependence on the above correlation.
- Genetic basis for number of anthers in a flower and total pollen production which in turn affects the overall pollen quality.
- Applications of the above study on improving food grain production by genetic modification of the plant.

CONCLUSIONS

The above studies on the correlation between anther number, the number of pollens per anther and per flower show that an increase in anther number results in a reduction of pollen production per anther and overall increase in pollen production of the flower. Further, upon studying the pollen quality produced and the affects of anther number on the pollination ability of the flower introduces a new scope of research. The application of the same in agricultural production makes this all the more significant. Hence, the research has to be performed diligently in order to implement the effects.

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